

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

TRUEPOSITION INC.,)	
)	
PLAINTIFF/)	
COUNTERCLAIM- DEFENDANT,)	
)	
)	
v.)	CIVIL ACTION NO. 05-00747-SLR
)	
ANDREW CORPORATION,)	
)	
DEFENDANT/)	
COUNTERCLAIM-PLAINTIFF.)	

**ANDREW CORPORATION'S RESPONSES TO
TRUEPOSITION'S SECOND SET OF INTERROGATORIES**

Pursuant to Rule 33 of the Federal Rules of Civil Procedure, Andrew Corporation hereby responds to TruePosition's Second Set of Interrogatories. Pursuant to Rule 26(e) of the Federal Rules of Civil Procedure, Andrew expressly reserves the right to supplement these responses further.

Interrogatory No. 16

Separately describe each instance in which Andrew has made, used, sold or offered for sale the Modified Geometrix System within the United States, or supplied or caused to be supplied any component of the Modified Geometrix System in or from the United States to a foreign country, including, for each such instance, the date, the precise act performed by Andrew on that date (*i.e.*, manufacture, use, sale, offer or supply) and the customer or potential customer for whom the Modified Geometrix System was made, demonstrated or tested or to whom the Modified Geometrix System was sold, offered or supplied.

Response:

Andrew objects to TruePosition's definition of "Modified Geometrix System" as misleading, confusing, and incomplete. For example, a Geometrix System consists of both

hardware and software. Moreover, in order to utilize any idle mode Mobile Terminated Location Request ("MT-LR") functionality in Andrew's software, at least two conditions must be met: (a) the network must be comprised of a specific hardware architecture; and (b) the network provider must possess a special software use license granted by Andrew. Andrew further objects to the phrase "Standalone Dedicated Control Channel Location feature" as vague, ambiguous, and confusing. Subject to and without waiving its Specific and General Objections, Andrew states:

Andrew's Geometrix System does not include a specific "Standalone Dedicated Control Channel Location feature." As explained in Andrew's supplemental response to TruePosition's Interrogatory No. 6, with Andrew's geolocation system, when a user wishes to locate a mobile cellular phone, the user through the cellular telephone system must provide Andrew's geolocation system with the channel assignment information for the signal to be received by Andrew's system. Andrew's system receives the signals using the assignment information provided, and determines the location of the signal source without regard to the identity of the transmission source or the type of signals being transmitted. Standalone dedicated control channels are an inherent part of a GSM cellular network and have been since the inception of GSM, which occurred more than at least one year before the filing date of the '144 Patent.

Interrogatory No. 18

Describe in detail Andrew's effort(s) to "displace" TruePosition from its attempt to obtain a contract with a STC for the provision of a Cellular Telephone Location System(s) (as referenced at, for example, AND_EF0000169, Slide 3), including Andrew's selection and compensation of any agents (including Al-Mishehal Commercial Group Ltd., EXI Saudi Arabia Ltd and NOVIAcom) retained to help Andrew win such a contract, the date of each payment made to any such agent, the amount of each such payment and the ultimate use or disposition of each such payment by such agent.

Response:

Andrew objects to this Interrogatory on the grounds that it requests information that is irrelevant to this litigation and is not reasonably calculated to lead to the discovery of admissible evidence. Andrew further objects to the term "agents" as vague and ambiguous. Subject to and without waiving its General and Specific Objections, Andrew states:

In the fall of 2004, both Andrew and TruePosition responded to a request for proposal issued by STC; both entities submitted bids to win a contract to supply a UTDOA system to STC with the understanding that only one UTDOA vendor would be chosen. Upon information and belief, AND_EF0000169 is an internal presentation prepared by Alan Li. Mr. Li was a consultant engaged by Andrew to serve as an interim program manager; he was never employed by Andrew and is no longer acting as a consultant for Andrew. Upon information and belief, the statement "[w]e believe we will displace them" found in AND_EF0000169 refers to the eventual installation of Andrew equipment into STC sites where TruePosition equipment had been previously installed for field trial purposes.

Andrew won the STC contract through the tender process.

Andrew has relationships with the following entities: Al-Misehal Group, Noviacom, and Ericsson. The nature of the relationships, services provided, and compensation are reflected in documents already produced to TruePosition. See AND_EF0001295; AND_EF0001298; AND0074035-49.

Interrogatory No. 19

Describe in detail each valuation of TruePosition, Inc. performed by or on behalf of Andrew since January 1, 2004 in connection with any potential business combination between Andrew and TruePosition, Inc., including the date of each such valuation, the dollar amount of each such valuation and the extent of any change in any such valuation resulting from Andrew's having won any contract with STC for the provision of a Cellular Telephone Location System(s).

From: Håkan Niska (EAB) <hakan.niska@era.ericsson.se>
Sent: Tuesday, April 15, 2003 8:58 AM
To: Håkan Niska (EAB) <hakan.niska@era.ericsson.se>; Marten Pehrson (EUS) <Marten.Pehrson@eus.ericsson.se>; Curt Wong (E-mail) <curt.c.wong@nokia.com>; Stephen Edge (E-mail) <Stephen.Edge@icm.siemens.com>; Jean-Jacques Genet (E-mail) <jjgenet@nortelnetworks.com>; Martin Dawson (E-mail) <mdawson@nortelnetworks.com>; Oskar Magnusson (E-mail) <oskar_magnusson@grayson-wireless.com>; Marvin Fuller (E-mail) <marvin.fuller@cingular.com>; Jeff Ferguson (E-mail) <jeff.ferguson@attws.com>; John Pottle (E-mail) <John.Pottle@T-Mobile.com>; Bob Gross (E-mail) <rbgross@trueposition.com>; burdett@nortelnetworks.com
Cc: Kari Kurronen (E-mail) <kari.kurronen@nokia.com>; Ville Ruutu (E-mail) <ville.ruutu@nokia.com>; Richard Kehoe (E-mail) <Richard.Kehoe@icm.siemens.com>; Christopher Emery (E-mail) <ccemery@nortelnetworks.com>; Kevin Donaghy (E-mail) <kdonaghy@trueposition.com>; Steve Hardin (E-mail) <steve.hardin@cingular.com>; Mark Dammrose (E-mail) <mark.dammrose@attws.com>; Joe Marx (E-mail) <joe.marx@attws.com>; Michael Anderson C (EUS) <Michael.C.Anderson@am1.ericsson.se>; Mina Karimi (EUS) <Mina.Karimi@am1.ericsson.se>; Tariq Muhammad (EUS) <Tariq.Muhammad@am1.ericsson.se>; Afshin Esmaeili (EUS) <Afshin.Esmaeili@am1.ericsson.se>; Guarino, Bernard <bernard.guarino@attws.com>
Subject: Approved version of RAN Architecture document
Attach: U-TDOAarchitecture-revA.doc; U-TDOAarchitecture-revA-withChangeMarks.doc

Hello all,
 Here is the approved version of "U-TDOA System Study, Architecture".
 I also append a change marked version showing changes after the final check.

A large thank you to all of you for your participation.
 It have been an open minded and productive co-operation in producing the document.

Thanks again Hakan

◇ ◇

> -----Original Message-----

> From: Håkan Niska (EAB)

> Sent: den 14 april 2003 12:45

> To: Marten Pehrson (EUS); Curt Wong (E-mail); Stephen Edge (E-mail); Jean-Jacques Genet (E-mail); Martin Dawson (E-mail); Oskar Magnusson (E-mail); Marvin Fuller (E-mail); Jeff Ferguson (E-mail); John Pottle (E-mail); Bob Gross (E-mail); 'burdett@nortelnetworks.com'

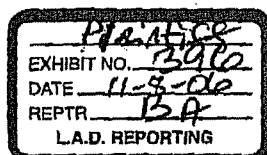
> Cc: Kari Kurronen (E-mail); Ville Ruutu (E-mail); Richard Kehoe (E-mail); Christopher Emery (E-mail); Kevin Donaghy (E-mail); Steve Hardin (E-mail); Mark Dammrose (E-mail); Joe Marx (E-mail); Michael Anderson C (EUS); Mina Karimi (EUS); Tariq Muhammad (EUS)

> Subject: Final check of RAN Architecture document

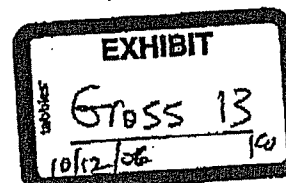
>

> Hello all,

>



A209.1



> Here is the updated version of Architecture document according to inspection 2003-04-11.
> After 24 hours I will send out the A revision.
> Please check that the update is according to the inspection.
>
>
> << File: U-TDOAArchitecturePA4.doc >> << File: U-TDOAArchitecturePA4withRevMarks.doc >>
>
> Regards Hakan
>
> -----Original Appointment-----
> From: Marten Pehrson (EUS)
> Sent: den 9 april 2003 00:14
> To: Marten Pehrson (EUS); Håkan Niska (EAB); Curt Wong (E-mail); Stephen Edge (E-mail); Jean-Jacques Genet (E-mail); Martin Dawson (E-mail); Oskar Magnusson (E-mail); Marvin Fuller (E-mail); Jeff Ferguson (E-mail); John Pottle (E-mail); Bob Gross (E-mail)
> Cc: Kari Kurronen (E-mail); Ville Ruutu (E-mail); Richard Kehoe (E-mail); Christopher Emery (E-mail); Kevin Donaghy (E-mail); Steve Hardin (E-mail); Mark Dammrose (E-mail); Joe Marx (E-mail); Michael Anderson C (EUS); Mina Karimi (EUS); Tariq Muhammad (EUS)
> Subject: Updated: Review of RAN Arcitechure and Lb/Lbis interface spefications
> When: den 11 april 2003 15:00-19:00 (GMT+01:00) Belgrade, Bratislava, Budapest, Ljubljana, Prague.
> Where: Telephone
>
> Resending due to a mistake in Bobs e-mail address. This time it is correct. /Marten
>
> Hi all,
>
> This is a call for the review meeting we decided upon when we met in Atlanta.
>
> Hakan and Curt will send their documents later on. This notice is to make you aware of the time and to make sure that they have the right distribution list.
>
> This notice is directed to:
> Cingular: Marvin Fuller
> AWS: Jeff Ferguson
> T-Mobile: John Pottle (I have no other name defined in the review group)
> Ericsson: Hakan Niska
> Nokia: Curt Wong
> Siemens: Stephen Edge
> Nortel: Jean-Jacques Genet
> Martin Dawson
> Grayson: Oskar Magnusson
> TruePosition: Bob Groos
>
> It is assumed that if these people need more people from their respective companies to join the review they coordinate this and bring those.
>
> Any other reciever of this mail is copied for information to make sure that if there is an error in the list above it can be corrected.
>
> Dial-in number:
> International access: +1 865 297 1124

> US domestic access: 1 866 703 9405
> Access code: 108 100
>
> /Marten

A209.3

ERICSSON Open
REPORT

1 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen	
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A
		Reference	

U-TDOA System Study, Architecture

Contents

1	Introduction.....	2
2	Original network architecture	3
3	Network architecture, U-TDOA addition to BSS	4
3.1	New or modified interfaces	6
3.1.1	Lbis interface	6
3.1.2	Lb interface.....	8
3.1.3	A interface.....	8
3.1.4	PDE-LMU interface.....	8
4	U-TDOA positioning procedure.....	9
4.1	Selection of positioning method.....	12
4.2	Timing	14
4.2.1	Call timing, mobile originating	14
4.2.2	Main procedure timing	16
4.2.3	Critical delays	18
4.3	Error cases	19
4.3.1	BSC error cases for U-TDOA method.....	19
4.3.2	Other BSS error cases for U-TDOA method	24
4.3.3	PDE state model.....	24
4.4	Special cases	25
5	Abbreviations.....	26
6	References	29
7	Document Revision History.....	30

ERICSSON Open
REPORT

2 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen		
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A	Reference

1

Introduction

This document is one part of "U-TDOA System Study". The "U-TDOA System Study" is ordered by AT&T Wireless and jointly executed by Ericsson and Nokia.

AT&T Wireless, Cingular, T-Mobile, Grayson, TruePosition, Nortel and Siemens have reviewed the documentation of the "U-TDOA System Study".

The main objectives with the architecture are:

- Remove the AMU
- Accurate identification of the mobile station for the positioning attempt
- Capability to handle multiple positioning methods
- Align with 3GPP standards

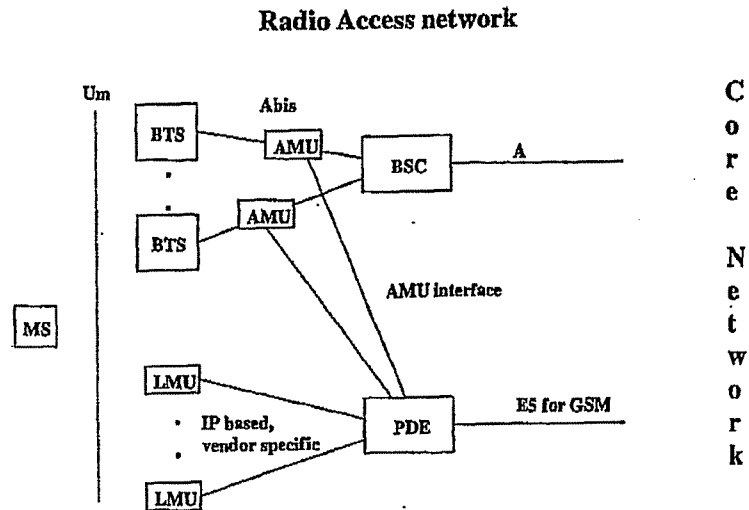
The study is limited to investigating positioning support for Emergency calls and U-TDOA supported by Grayson or TruePosition. This implies that only the Circuit Switched domain and A interface mode is included in the study. The study is also limited to impacts on GSM BSS. GSM Core network functionality is independent of the positioning method selected. For Emergency services some specific configurations in the core network may be required.

ERICSSON Open
REPORT

3 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen		
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A	Reference

2

Original network architecture

The main feature of this architecture is that using U-TDOA does not have any influence on the GSM-BSS, except antenna sharing.

AMUs are connected to the Abis link to trace calls made in the radio network. When an emergency call is made, the AMU gives radio related information about the emergency call to the PDE. The PDE order a number of LMUs to capture uplink bursts and calculate TOA. The PDE coordinates and support this activity among selected LMUs. When enough TOA information has been collected and passed to the PDE, the PDE can compute the geographical position of the mobile station.

The geographical position is sent, over The "E5 for GSM" interface, to the core network for use in emergency centres.

Main drawbacks with this architecture:

- The identity of the mobile station is not unambiguously defined. In the core network, the time of the call is compared with the time of the positioning and from this an association is made.
- AMU logic to catch emergency calls is quite complicated.

The above is a condensed description [1] to give a background.

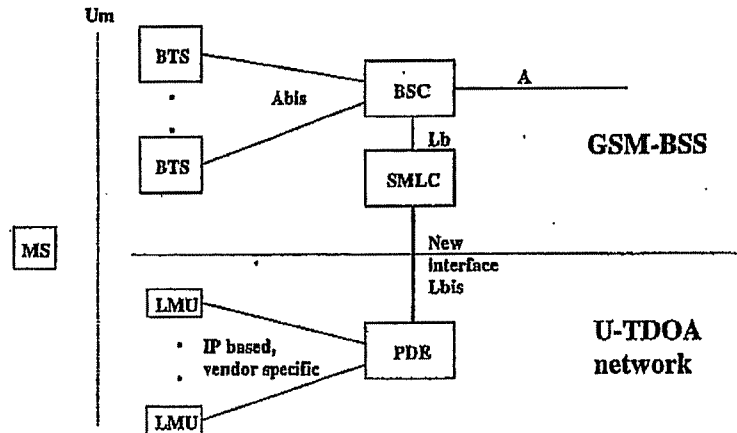
A209.6

ERICSSON Open
REPORT

4 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen	
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A
		Reference	

3

Network architecture, U-TDOA addition to BSS

The architecture makes a clear and maintainable separation between BSS and the U-TDOA specific parts. The U-TDOA part consists of the control and positioning unit PDE (Positioning Determination Equipment) that communicates over a new interface (Lbis) to BSS. The PDE has dedicated connections to LMUs under its direct control. The connections between the PDE and its LMUs, are physically separated from the Abis interface. If the PDE require service from LMUs controlled by another PDE, a PDE to PDE connection is required (not shown in the figure above). The LMUs are also physically connected to the BTS antennas to catch uplink bursts from the mobile stations. From the BSS side, the PDE is considered as an external implementation of the position method U-TDOA. This Lbis interface arrangement allows for connection to a BSC without an Lb interface; i.e. an SMLC integrated with a BSC.

The AMU function, to identify the call and to define the radio channel used by the mobile station, is replaced by Core Network and BSC functions. The MSC is identifying the call (an Emergency Call) that requires positioning. The MSC, through the VLR function, then also has an unambiguous subscriber identity that can be associated with the positioning (not possible when the AMU function is used). The BSS will supply the PDE with parameters defining the radio channel used by the mobile station.

From the positioning point of view, other positioning methods can be implemented in the SMLC such as a GPS method.

ERICSSON Open
REPORT

5 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen		
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A	Reference

Standardisation of the U-TDOA method is not yet completed, but this architecture is aligned with the CR [2] proposed to GERAN#13. The architecture follows [3] for CS mode over the A-interface. New messages are proposed for the Lb interface to be added in [4].

In aligning the architecture to the standard, the architecture is prepared for future standard enhancements in methods or U-TDOA features.

A209.8

ERICSSON Open
REPORT

6 (31)

Prepared (also subject responsible if other)		No.	
LM/EAB/RJT Håkan Niska		EAB/RJT-03:014 Uen	
Approved	Checked	Date	Rev
EAB/RJT Ulf Aronzon		2003-04-15	A
		Reference	

3.1 New or modified interfaces

3.1.1 Lbis interface

Lbis is a new interface. On the Lbis interface there are two logical links defined, RP (Remote PDE) link and NMS link. The RP link carries signalling information for the actual positioning attempts, and the NMS link is used by PDE to retrieve configuration data from the SMLC.

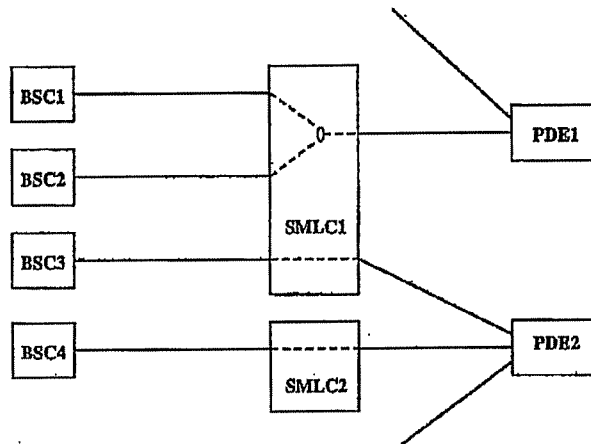
Common characteristics:

- Based on TCP/IP
- Client -- Server interface
- Redundant service. Each server shall allow configuration of at least two hardware independent TCP/IP ports for the same service. Each client shall allow configuration of two hardware independent links to the same service. It is not required that more than one link, for the same service, is actually used at one point in time. It is allowed to have only one TCP/IP port if it is hardware redundant. It shall be possible to have the server or client service geographically distributed. This applies to RP-link and NMS link.
- One SMLC can be connected to one or more PDEs. Mapping to PDE is per BSC basis (see figure below)
- One PDE can be connected to one or more SMLCs (see figure below).

ERICSSON Open
REPORT

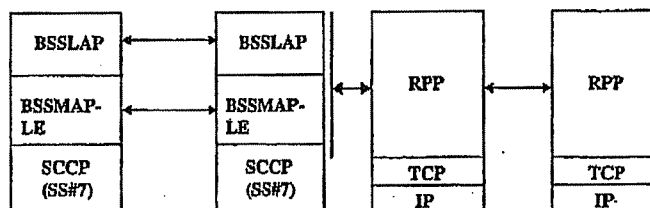
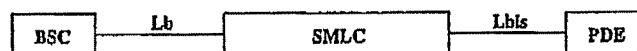
7 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen		
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A	Reference



3.1.1.1 RP link

For the RP link, the PDE side is the server and the SMLC side is the client. The PR link protocol is RPP (Remote PDE Protocol) and the relation with Lb and LbIs protocols are shown in the figure below.



A209.10

ERICSSON Open
REPORT

8 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen		
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A	Reference

When U-TDOA positioning method is used, RPP bridges relevant information between the SMLC and the PDE. For one individual positioning request one SCCP connection is established on the Lb interface (referring to an actual mobile station connection in BSC). To reflect the SCCP connection SMLC defines a Transaction_ID to be used in RPP. As long as the SCCP connection is established there is a one to one relation between BSC-SCCP_number and RP_link_individual-Transaction_ID.

The RP link and the RPP messages are further described in [6].

3.1.1.2 NMS link

For the NMS link, the SMLC side is the server and the PDE side is the client.

The NMS link is further described in [7].

3.1.2 Lb interface

The changes in the Lb Interface are described in [6].

3.1.3 A interface

The only change in the A interface, when U-TDOA positioning method is introduced, is addition of a new code point. The code point indicates U-TDOA in the information element "Positioning Data" [5].

3.1.4 PDE-LMU interface

This interface is beyond the scope of this study.

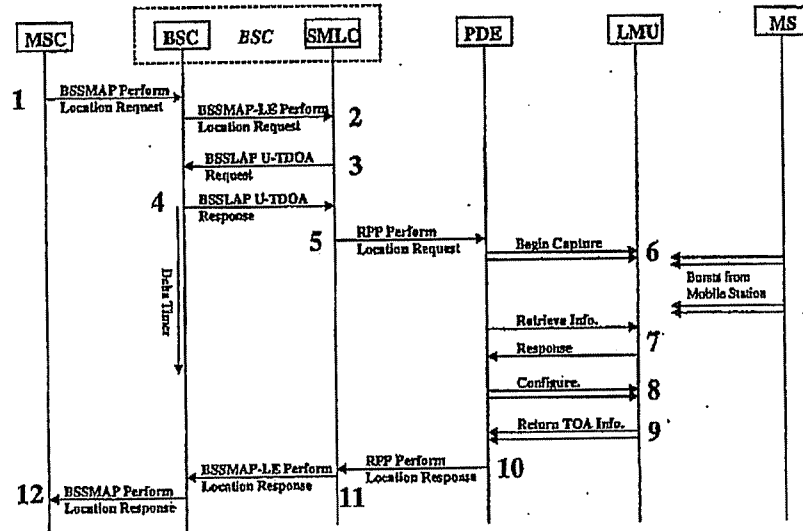
A209.11

ERICSSON Open
REPORT

9 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen	
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A
		Reference	

4

U-TDOA positioning procedure

The sequences are based on standard suggestion [2].

Prerequisites: The mobile station has initiated a call (e.g. emergency call) and is connected over the BSS to the serving MSC/VLR. In the radio interface the mobile station is allocated to a SDCCH or a TCH. The mobile station connection is associated with a SCCP connection in the A interface. The MSC decides to request a position of the mobile station.

- 1 The message "BSSMAP Perform Location Request" is sent from the MSC to the BSC over the previously established SCCP connection in the A interface (SCCPa). The MSC request positioning of the mobile station associated with SCCPa.
- 2 The BSC forward the message content received in 1, in the message "BSSMAP-LE Perform Location Request", to the SMLC. This is made with a SCCP set up request in the Lb interface (SCCPb). The SCCPa is the reference for the mobile connection in the A interface. The SCCPb is the identification for the positioning transaction in the Lb interface. The BSC keeps an association between SCCPa and SCCPb during the whole positioning transaction over the Lb interface (2-11 in the figure above).

A209.12

ERICSSON Open
REPORT

10 (31)

Prepared (also subject responsible if other) LM/EAB/RJT Håkan Niska		No. EAB/RJT-03:014 Uen	
Approved EAB/RJT Ulf Aronzon	Checked	Date 2003-04-15	Rev A
		Reference	

- 3 The SMLC will now select one method to provide geographic position for the mobile station. See later section in this document about how to select positioning method to use. Here we assume that the U-TDOA method is selected. The SMLC request radio channel information for the mobile station (SCCPb) from the BSC with the message "BSSLAP U-TDOA Request". The parameter in this message is "Delta Timer". The parameter "Delta Timer" is provisioned in the SMLC by O&M.
- 4 The BSC collects relevant information about the radio connection for the mobile station (see [6]). The main parameters are CGI, radio channel description and ciphering key. The BSC inserts the parameters in a reply message "BSSLAP U-TDOA Response", on the same SCCP connection as message 3 was received on (SCCPb), to the SMLC. If the mobile station is not in a "steady state", some RR procedures ongoing (see [2]), the BSC awaits a "steady state" before the parameters are collected. From the point in time when the BSC has sent "BSSLAP U-TDOA Response" the BSC is responsible to supervise the mobile station connection for changes affecting U-TDOA measurements in the radio interface. This supervision is controlled by a state in the BSC called **U-TDOA_supervision** in this document. The state **U-TDOA_supervision** has two values **ON** or **OFF**, default value is **OFF**). The supervision in the BSC starts when the BSC sends message "BSSLAP U-TDOA Response" and set the U-TDOA_supervision state to ON. The supervision in the BSC ends when the first of the following four events occurs. **Event 1:** Optionally the BSC can start one timer with value "Delta Timer", when the BSC sends message "BSSLAP U-TDOA Response". When this timer expires the U-TDOA_supervision state is set to OFF. **Event 2:** When message 11 in the sequence above is received in the BSC the U-TDOA_supervision state is set to OFF and the "Delta Timer" is stopped (if used). **Event 3:** If any BSSLAP message is received over the actual SCCP connection (SCCPb), the U-TDOA_supervision state is set to OFF and the "Delta Timer" is stopped (if used). **Event 4:** If a "BSSLAP Reset", "BSSLAP Reject" or "BSSLAP Abort" is sent to the SMLC, the U-TDOA_supervision state is set to OFF and the "Delta Timer" is stopped (if used).

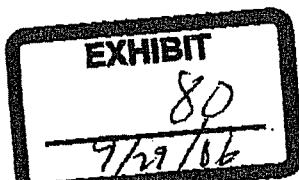
A209.13



ATIS STANDARD

ATIS-0700002

**UTDOA Lbis Interface:
Architecture and Functional Description**



TECHNICAL REPORT

A209.14



The Alliance for Telecommunication Industry Solutions (ATIS) is a technical planning and standards development organization that is committed to rapidly developing and promoting technical and operations standards for the communications and related information technologies industry worldwide using a pragmatic, flexible and open approach. Over 1,100 participants from more than 350 communications companies are active in ATIS' 23 industry committees and its Incubator Solutions Program.

< <http://www.atis.org/> >

NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim or any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

ATIS-0700002, *UTDOA Lbis Interface: Architecture and Functional Description*

Is an ATIS Standard developed by the **UTDOA Ad Hoc Committee** under the **ATIS Wireless Technologies and Systems Committee (WTSC)**.

Published by
Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

Copyright © 2006 by Alliance for Telecommunications Industry Solutions
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org/> >.

Printed in the United States of America.

ATIS-0700002

Technical Report on

UTDOA LBIS INTERFACE: ARCHITECTURE AND FUNCTIONAL DESCRIPTION

Secretariat

Alliance for Telecommunications Industry Solutions

Approved August, 2004

Abstract

This Technical Report describes how the UTDOA position determination system for locating mobile stations may be applied to GSM networks in a manner consistent with 3GPP and other relevant standards. UTDOA (uplink time difference of arrival) is one of the location technologies identified in the 3GPP GSM standards. The Lbis interface and Remote PDE Protocol (RPP) enable upgrading earlier proprietary implementations of UTDOA to a standards-based solution with minimal impact to the network infrastructure. This document is the first of a three-part set that describe the Lbis interface and RPP in detail. This document describes the functional architecture and the location procedures using call flow diagrams (stage 2 description). The other two documents will describe, separately, the signaling and OAM protocols (stage 3 description). Informative Annexes to this document cover discussions and concerns raised in the UTDOA technical community during the development of the Lbis interface.

A209.16

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Wireless Technologies and Systems Committee (WTSC) - formerly TIP1 - develops and recommends standards and technical reports related to wireless and/or mobile services and systems, including service descriptions and wireless technologies. WTSC develops and recommends positions on related subjects under consideration in other North American, regional and international standards bodies.

This document is entitled *UTDOA Lbis Interface: Architecture and Functional Description*.

This technical report is intended for use in conjunction with standard T1.3GPP.22.071: Location Services (LCS)-Stage 1 and T1.3GPP.23.271: Technical Specification Group Services and System Aspects; Functional stage 2 description of LCS.

Footnotes are not officially part of this document.

Future control of this document will reside with Alliance for Telecommunications Industry Solutions. This control of additions to the specification, such as protocol evolution, new applications, and operational requirements, will permit compatibility among U.S. networks. Such additions will be incorporated in an orderly manner with due consideration to the ITU-T layered model principles, conventions, and functional boundaries.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC Secretariat, 1200 G Street NW, Suite 500, Washington, DC 20005.

Committee WTSC chartered the UTDOA Ad Hoc Committee to provide technical assistance in reviewing this report.

ATIS-0700002

TABLE OF CONTENTS

FOREWORD	II
INTRODUCTION/EXECUTIVE SUMMARY	1
1 SCOPE, PURPOSE, AND APPLICATION	1
2 NORMATIVE REFERENCES USED IN THIS TECHNICAL REPORT	1
3 DEFINITIONS	2
4 ABBREVIATIONS, ACRONYMS, AND SYMBOLS	2
5 NETWORK ARCHITECTURE, UTDOA ADDITION TO BSS	4
5.1 LBIS FUNCTIONAL ARCHITECTURE	4
5.1.1 Lbis Interface	5
5.1.1.1 RP Link Protocol Details	6
5.1.2 Lb Interface	7
5.1.3 PDE-LMU interface	7
5.2 OA&M ARCHITECTURE	9
5.2.1 Data-Sharing Interface	9
6 UTDOA POSITIONING PROCEDURE	9
6.1 SELECTION OF POSITIONING METHOD	12
6.2 TIMING	13
6.2.1 Call Timing, Mobile Originating	13
6.2.2 Main Procedure Timing	15
6.2.2.1 T1 Positioning Request Timer	15
6.2.2.2 T2 Positioning Method Timer	15
6.2.2.3 Delta Timer	16
6.2.3 Critical Delays	16
6.3 ERROR CASES	17
6.3.1 BSC error cases for UTDOA method	17
6.3.1.1 UTDOA_Abort/Reject when UTDOA_supervision is OFF	18
6.3.1.2 Reset Case When UTDOA supervision is ON	19
6.3.1.3 Abort and Reject cases when UTDOA_supervision is ON	20
6.4 SPECIAL CASES	20
6.4.1 High Speed Circuit Switched Data	20
6.4.2 DTM	21
ANNEX A ENGINEERING ANALYSIS OF UTDOA IN THE GERAN ENVIRONMENT: POSSIBLE UTDOA RADIO AND FEATURE INTERACTIONS	22
A.1 INTRODUCTION	22
A.2 UTDOA VERSUS FREQUENCY PLANNING	22
A.2.1 BCCH Frequency	23
A.2.2 Non-BCCH Frequency	23
A.2.3 Further Development	24
A.2.4 Conclusion	24
A.3 UTDOA VERSUS POWER CONTROL UPLINK	25
A.3.1 Power Control during Early Phases	26
A.3.2 The "Mid-911" Scenario	27
A.3.3 Further Development	27
A.3.4 Conclusion	27
A.4 DTX SWITCHED OFF FOR EMERGENCY CALLS	28
A.4.1 Further development	29
A.4.2 Conclusion	29
A.5 UTDOA VERSUS AMR	30
A.6 UTDOA VERSUS SMART ANTENNAS	30
A.7 UTDOA VERSUS CELL PLANS	30
A.8 INTERACTION WITH OTHER FEATURES	30

ATIS-0700002

ANNEX B	SECURITY AND PRIVACY CONSIDERATIONS RELATED TO LBIS IMPLEMENTATION.....	31
B 1	IP NETWORK ATTACKS	31
B 2	KEY TRANSMISSION	31
B 3	CIPHER MODE	31
B 4	PRIVACY OF POSITIONING INFORMATION	32
ANNEX C	BACKGROUND OF THE LBIS INTERFACE AND THIS TECHNICAL REPORT	33
C 1	OBJECTIVES OF THE IMPROVED ARCHITECTURE	34
C 1.1	<i>Use 3GPP standard methods for the PerformLocationRequest function.....</i>	<i>34</i>
C 1.2	<i>Unambiguous MS Identification.....</i>	<i>35</i>
C 1.3	<i>Implement UTDOA as a PDE that the SMLC Tasks.....</i>	<i>35</i>
C 1.4	<i>Maximize alignment between UTDOA and 3GPP GERAN standards.....</i>	<i>35</i>
C 2	HIGH LEVEL PERSPECTIVE OF THE LBIS INTERFACE	35

TABLE OF FIGURES

FIGURE 1: LBIS NETWORK ARCHITECTURE TO SUPPORT UTDOA.....	5
FIGURE 2: MULTIPLE LBIS LINKS.....	6
FIGURE 3: RPP (REMOTE PDE PROTOCOL) ARCHITECTURE.....	7
FIGURE 4: GSM BSS LOGICAL DATA AND INTERESTED CLIENT SUBSYSTEMS	8
FIGURE 5: GSM BSS UTDOA SUBSYSTEM INTERFACE.....	9
FIGURE 6: UTDOA POSITIONING MESSAGE FLOW.....	10
FIGURE 7: SELECTION OF POSITIONING METHOD.....	12
FIGURE 8: EXAMPLE OF SELECTION LOGIC.....	13
FIGURE 9: MOBILE ORIGINATION CALL TIMING.....	14
FIGURE 10: POSITIONING PROCEDURE TIMING	15
FIGURE 11: CRITICAL DELAYS IN POSITIONING PROCEDURE	16
FIGURE 12: BSSLAP ABORT/REJECT PROCEDURES (UTDOA_SUPERVISION OFF).....	18
FIGURE 13: BSSLAP RESET PROCEDURE (UTDOA_SUPERVISION ON).....	19
FIGURE 14: BSSLAP ABORT PROCEDURES (UTDOA_SUPERVISION ON).....	20
FIGURE 15: A CELL WITH 3 TRX.	23
FIGURE 16: ORIGINAL NETWORK ARCHITECTURE	33

TABLE OF TABLES

TABLE 1: ABBREVIATIONS & ACRONYMS	2
TABLE 2: BSSLAP BSC ERROR CAUSE VALUES.....	18
TABLE 3: ESTIMATES FOR C/I FOR DIFFERENT CELL CONFIGURATIONS	24
TABLE 4: E911 ON A BCCH CARRIER - RECOMMENDATIONS	25
TABLE 5: CORRELATION OF MS POWER CONTROL DOWN REGULATION AND REQUIRED NUMBER OF BURSTS	26
TABLE 6: POWER CONTROL ISSUE SUMMARY	28
TABLE 7: DTX ISSUE SUMMARY	29

TECHNICAL REPORT**ATIS-0700002**

Technical Report on –

UTDOA Lbis Interface: Architecture and Functional Description

INTRODUCTION/EXECUTIVE SUMMARY

This document describes the GSM architectural enhancements and related functional procedures for realizing a UTDOA positioning method solution using the Lbis interface defined here. Reference ATIS-0700003 August 2004, UTDOA Lbis Interface: Remote PDE Protocol (RPP) describes an implementation of the Lbis signaling protocol, and reference. The other interfaces and procedures supporting the GSM UTDOA solution are part of the 3GPP-defined GSM specifications (see Normative References in Clause 2 below)

This document is published as a Technical Report and not as a Technical Standard. The principal reason for a "TR" rather than a "TS" is that the 3GPP standard identifies the operation of the PDE within the SMLC as being up to the vendors. Nothing in this report is intended to limit, amend, or detract from the published 3GPP and T1 standards relevant to the support of location services within a wireless, digital network. What is offered here, rather, is an approach to implementing a remote PDE such as UTDOA in a digital network such as GSM as defined in 3GPP standards.

Three informative annexes are attached to this report describing, respectively,

- ♦ Annex A: Engineering analysis of UTDOA in the GERAN environment
- ♦ Annex B: Potential security and privacy issues in Lbis implementation
- ♦ Annex C: An overview and historical perspective on the efforts to integrate UTDOA with GSM.

1 SCOPE, PURPOSE, AND APPLICATION

This document addresses integration of an uplink TDOA positioning technology as a remote PDE operating within a GERAN complex as defined in 3GPP Release 6.0. This integration constitutes vendor implementation details of a Location System. 3GPP standards for LCS identify such details as are presented here as being outside the scope of the 3GPP standards. The purpose here, then, is to provide a full description of implementation of a remote PDE such as might be employed in support of an LCS client such as an emergency services (ES) public services access point (PSAP)

The Lbis interface is applicable to North American GSM networks using UTDOA in support of E911 Phase 2 emergency services. The interfaces, protocols, and methods described here are potentially applicable to the integration of other remote PDEs to GERAN and/or UTRAN complexes.

2 NORMATIVE REFERENCES USED IN THIS TECHNICAL REPORT

This technical report is not a standard, and contains no normative references of its own. All standards referred to in the report are subject to revision, and the parties to agreements based on this report are encouraged to investigate the possibility of applying the most recent edition of the standards and reports indicated below.

ATIS-0700002

ATIS-0700003 August 2004, *UTDOA Lbis Interface: Remote PDE Protocol (RPP)*.¹

IETF RFC793, *Transmission Control Protocol*.²

T1.3GPP.49.031 v6.1.0, *Base Station System Application Part; LCS Extension (BSS-LE)*.¹

T1.3GPP.48.071 v.6.3.0, *Serving Mobile Location Center - Base Station System (SMLC-BSS) interface; Layer 3 specification*.¹

T1.3GPP.43.059 v6.1.0, *Functional stage 2 description of Location Services (LCS in GERAN)*.¹

T1.3GPP.22.071, *Location Services (LCS)-Stage 1*.¹

T1.3GPP.23.271, *Technical Specification Group Services and System Aspects; Functional stage 2 description of LCS*.¹

3 DEFINITIONS

3.1 Lbis: An interface between a GERAN-defined SMLC and a remote PDE controller such as may be employed in commercially available UTDOA systems.

4 ABBREVIATIONS, ACRONYMS, AND SYMBOLS

Table 1 provides project-specific terms and acronyms used in this document.

Table 1: Abbreviations & Acronyms

3GPP	Third Generation Partnership Project
A	Interface between MSC and BSS (A-interface)
Abis	Interface between the BSC and BTS (Abis-interface)
AMU	Abis Monitoring Unit, a network monitor used to identify ES calls and call parameters
ARFCN	Absolute Radio Frequency Channel Number
BSC	Base Station Controller
BSS	Base Station Subsystem
BSSAP-LE	Base Station Subsystem Application Part - LCS Extension
BSSLAP	BSS LCS Assistance Protocol
BTS	Base Transceiver Station
CGI	Cell Global Identifier
CI	Cell Identity
CR	Change Request
CS	Circuit Switched
DTM	Dual Transfer Mode
DTX	Discontinuous Transmission

¹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < <https://www.atis.org/docstore/default.aspx> >

² This document is available from the Internet Engineering Task Force (IETF). < <http://www.ietf.org> >

ATIS-0700002

EOTD	Enhanced Observed Time Difference
ES	Emergency Services
ESME	Emergency Services Messaging Entity
GSM	Global System for Mobile Communications
GPS	Global Positioning System
HSCSD	High Speed Circuit Switched Data
HSN	Hopping Sequence Number
IP	Internet Protocol
LAC	Location Area Code
Lb	Interface between BSC and SMLC (Lb-interface)
Lbis	Interface between SMLC and PDE (Lbis-interface)
LCS	Location Services
LMU	Location Measurement Unit
MAIO	Mobile Allocation Index Offset
MCC	Mobile Country Code
MNC	Mobile Network Code
MS	Mobile Station
MSC	Mobile Switching Center
O&M	Operations & Maintenance
PCF	Position Calculation Function
PDE	Positioning Determination Entity
QoS	Quality of Service
RAN	Radio Access Network
RDSP	RAN Data Synchronization Protocol
RF	Radio Frequency
RP	Remote PDE
RPP	Remote PDE Protocol
RR	Radio Resources
RRFCN	Relative Radio Frequency Channel Number
RT	Response Time
SACCH	Slow Associated Control Channel
SCCP	Signaling Connection Control Part
SDCCH	Stand-Alone Dedicated Control Channel
SID	Silence Descriptor
SMLC	Serving Mobile Location Center
TCH	Traffic Channel
TCH/F	A full rate TCH
TCP	Transmission Control Protocol
TDMA	Time Division Multiple Access
TDOA	Time Difference Of Arrival
TMSI	Temporary Mobile Subscriber Identifier
TN	Timeslot Number
TOA	Time Of Arrival
TSC	Training Sequence Code

ATIS-0700002

UTDOA	Uplink - Time Difference Of Arrival
Um	Interface between MS and BSS (Um-Interface)
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service
VLR	Visitor Location Register

5 NETWORK ARCHITECTURE, UTDOA ADDITION TO BSS

5.1 Lbis Functional Architecture

The Lbis architecture consists of three major elements:

1. A GSM network as defined in 3GPP standards, and including an LCS capability implemented in a stand-alone SMLC through the Lb interface.
2. A UTDOA system supporting a controller
3. An interface between the SMLC and the UTDOA controller through which the SMLC is able to task the UTDOA system to perform location requests, and through which the UTDOA controller is able to report status and location results.

Other highlights of this architecture include:

- ♦ The Lbis architecture is designed to have no impact on the installation, operation, or performance of the GSM RAN complex other than uplink antenna sharing for the UTDOA LMUs.
- ♦ The Lb/Lbis interface introduced in the new architecture provides a clear and maintainable separation between the BSS and the UTDOA-specific parts, consistent with the model for RAN/PDE separation expressed in the GERAN standards.
- ♦ The Lbis architecture does not raise UTDOA to the status of a fully supported PDE within the GERAN specification for the SMLC (such as is the case for CID+TA). This is because the SMLC does not perform the PCF for UTDOA. But the Lbis architecture does define how a remote PDE, such as UTDOA, can be operated through the GSM LCS capabilities in a manner consistent with standards. The Lbis interface permits a GSM BSS system to communicate with the remote UTDOA PDE through the SMLC *as if UTDOA were inter-implemented in the SMLC*. Specifically, the new architecture employs the Lg and Lb interfaces for LCS support of UTDOA-obtained position information.

Figure 1 shows the new network architecture to support UTDOA. The UTDOA part consists of the control and positioning unit—the PDE that communicates over a new interface (Lbis) to the GSM-BSS. The PDE also supports dedicated connections to the LMUs under its direct control. The connections between the PDE and its LMUs are physically separated from the BSS complex. If the UTDOA PDE requires service from LMUs controlled by another PDE, a PDE-to-PDE connection is required (not shown in Figure 1). The LMUs are also RF-coupled to the BTS antennas to retrieve uplink bursts from the MSs.

From the BSS side, the PDE is treated as an external (remote) implementation of the UTDOA positioning method. A new interface, Lbis, is introduced to link the external PDE to the BSS complex. This Lbis interface arrangement allows for connection of a remote PDE to a BSS complex without requiring that the UTDOA PDE support full SMLC functionality. The other major benefit of this arrangement is that no new interface is required to the BSC. The BSC communicates to the remote PDE

ATIS-0700002

through the Lb interface to the SMLC, just as it communicates with PDEs supported internally by the SMLC.

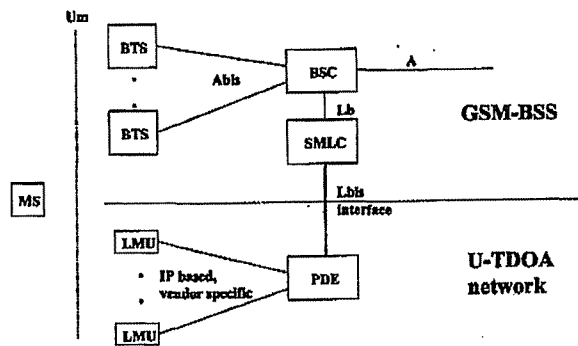


Figure 1: Lbis Network Architecture to support UTDOA

In the architecture depicted in Figure 1, the MSC identifies a call (for example an emergency call) that requires position determination of the MS. Location services activity starts when the MSC generates its PerformLocationRequest message to the GSM BSS. The A interface and Lb interface signaling used are as defined in 3GPP standards. The enhancement is that through the Lbis interface signaling, the BSS and SMLC supply the PDE with the location request and with parameters defining the radio channel used by the mobile station. The BSC ensures a unique association between the mobile station being located and the location request transactions with both the SMLC (over the Lb interface) and PDE (over the Lbis interface). This effectively provides an unambiguous mobile station identity that can be associated with a reported position from the PDE.

From the LCS perspective, other positioning methods could be supported in the same SMLC—methods such as CID+TA or GPS. The SMLC could task any PDE available to it without regard for whether the PDE and corresponding Position Calculation Function (PCF) was internal (in the SMLC) or remote as in the case of UTDOA.

Because the Lbis architecture is consistent with 3GPP GERAN standard, the architecture is adaptable to future standards enhancements in GSM BSS methods or U-TDOA features.

5.1.1 Lbis Interface

The Lbis interface defines two logical links: the RP (Remote PDE) link and optionally the RDS (Remote Database Sharing) link. The RP link carries signaling information for the actual positioning attempts. The RDS link supports administrative functions—specifically the updating of PDE databases from the SMLC. The “Data-Sharing” link is further described in the clause “OA&M architecture” of Clause 5.2 below.

The common characteristics of both links include:

- ◆ Based on TCP/IP
- ◆ Client - Server interface
- ◆ Redundant service. In keeping with general industry good practices, the Lbis interface implementation should support a configuration of at least two hardware-independent TCP/IP ports for the same service. Each client should allow configuration of two hardware-independent

ATIS-0700002

links to the same service. It is not required that more than one link for the same service is actually used at one point in time. It is allowable to have only one TCP/IP port if it is hardware-redundant. In practice, the BSCs, SMLCs, and PDEs are likely to be geographically distributed. Geographical distribution implies wide-area network support for the bearer network. This applies to the RP link and the RDS link.

- ♦ One SMLC can be connected to one or more PDEs. Mapping to the PDE is on a per-BSC basis (see Figure 2)
- ♦ One PDE can be connected to one or more SMLCs (see Figure 2)

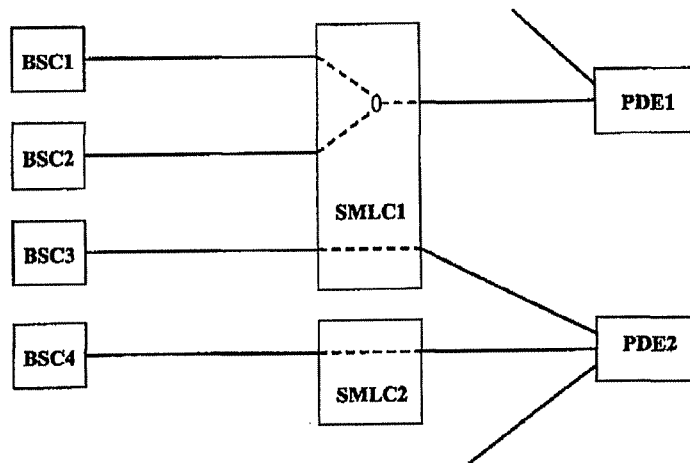


Figure 2: Multiple Lbis Links

5.1.1.1 RP Link Protocol Details

For the RP link, the PDE side is the server and the SMLC side is the client. The RP link protocol is RPP (Remote PDE Protocol). The relationships between the protocols used in the Lb and Lbis links are shown in Figure 3.

CERTIFICATE OF SERVICE

I, Francis DiGiovanni, hereby certify that on this 2nd day of February, 2007, I caused a true and correct copy of the foregoing **APPENDIX A TO TRUEPOSITION, INC.'S MOTON FOR SUMMARY JUDGMENT ON ANDREW'S COUNTERCLAIMS II-VI AND AFFIRMATIVE DEFENSES III-V, PART 2, A133 – A209.25** upon the following individuals in the manner indicated below:

Via hand-delivery

Josy W. Ingersoll, Esq.
Young Conaway Stargatt & Taylor, LLP
100 West Street, 17th Floor
Wilmington, DE 19801
jingersoll@ycst.com

Via e-mail

Patrick D. McPherson, Esq.
Duane Morris LLP
1667 K Street, N.W.
Washington, DC 20006-1608
PDMcPherson@duanemorris.com

Via e-mail

Rachel Pernic Waldron, Esq.
Kirkland & Ellis LLP
200 East Randolph Drive
Chicago, IL 60601
rpernicwaldron@kirkland.com

/s/ Francis DiGiovanni

Francis DiGiovanni (# 3189)